

# The SDSS SN Survey: Results and Prospects

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OF NEW JERSEY

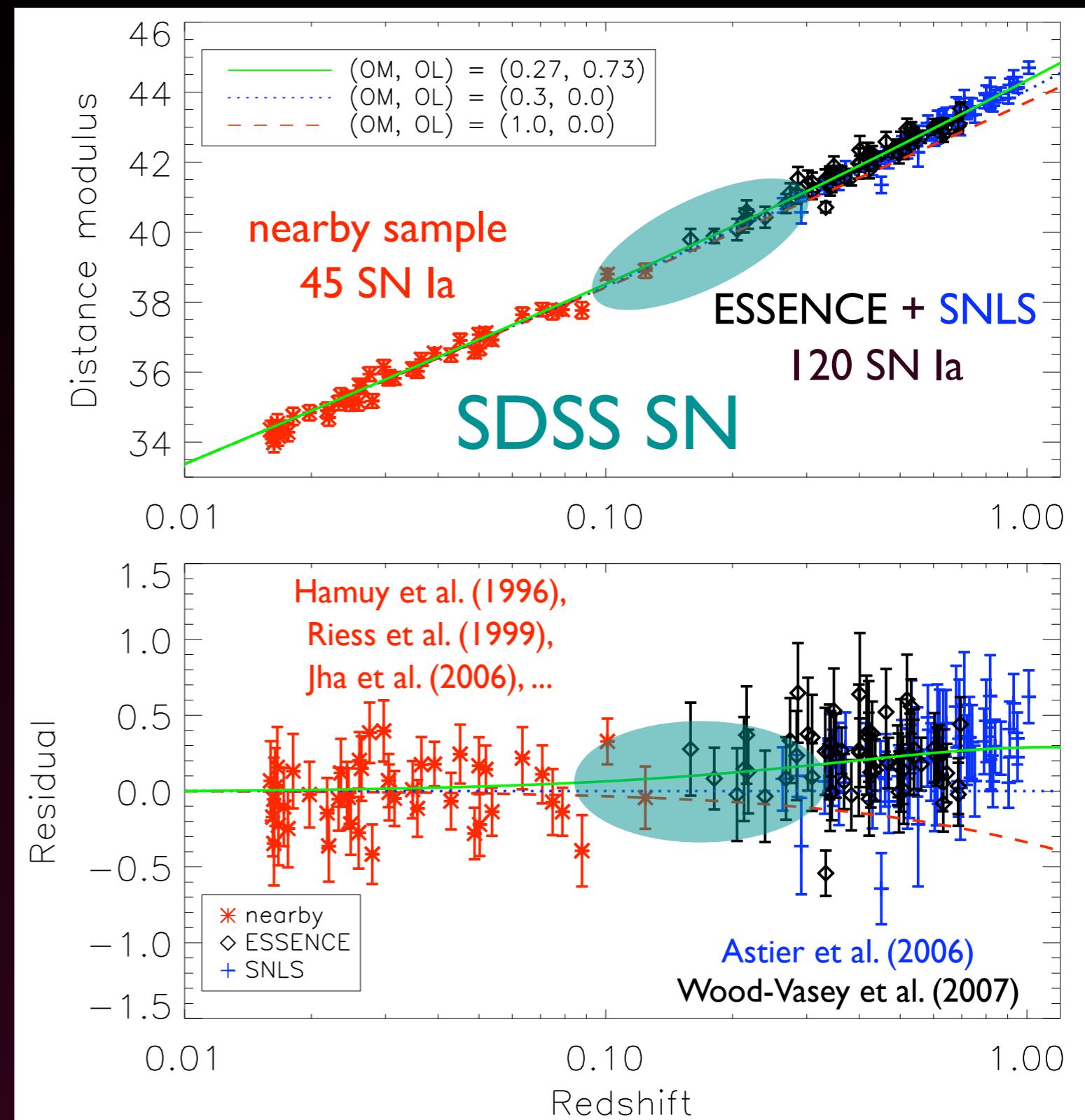
Saurabh Jha

for the SDSS-II SN collaboration



# SN Ia Hubble Diagram

- goal of the SDSS SN survey:  
fill in SN Ia Hubble diagram  
at redshifts  $0.1 \leq z \leq 0.3$ 
    - connect low-z with high-z
    - test the concordance cosmology
  - challenges
    - peak magnitude  $m \approx 20-22$
    - must search hundreds of square degrees of sky
- SDSS 2.5m telescope  
+ imager



# SDSS-II SN Survey Team

**Fermilab**  
**U Chicago**  
**APO**

**U Washington**

**NMSU**

**OSU**

**U Tokyo**

**U Portsmouth**

**KIPAC**

**U Penn**

**Rutgers**

**SAAO**

**RIT**

**Penn State**

**Notre Dame**

**STScI**

**Wayne State**

**SNU**

**HET team**

**ESO team**

**MDM team**

**Subaru team**

**KPNO team**

**Keck team**

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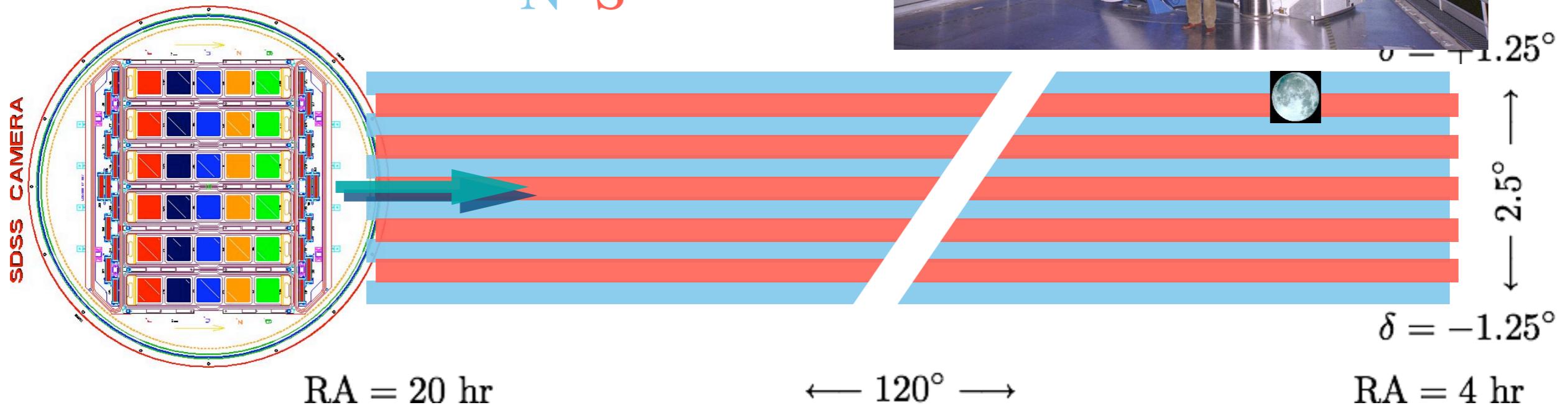
R. Foley, A. Filippenko



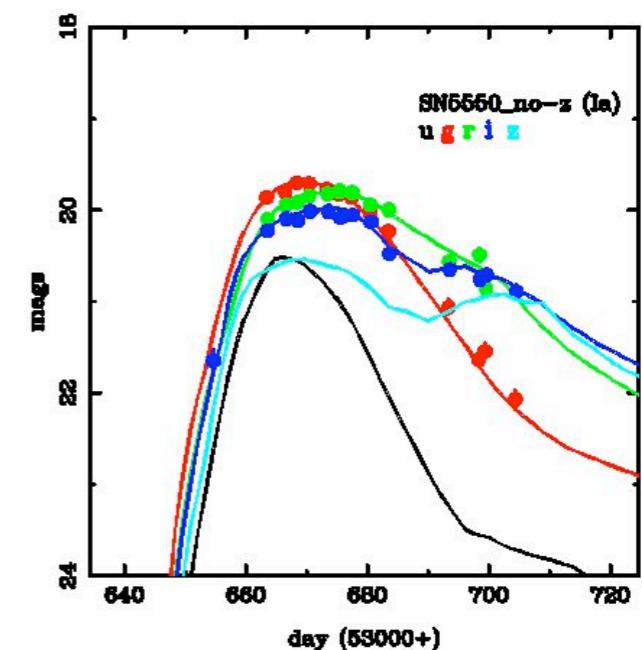
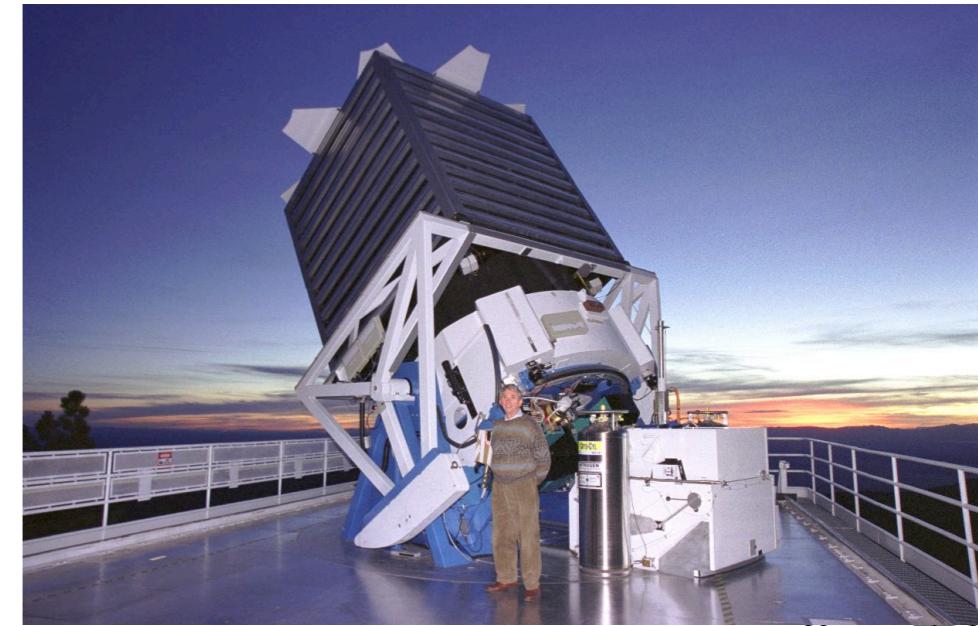
# SNe Survey

September 1 – November 30 of 2005-2007  
Scan 280 sq. degrees every 2 days  
multi-color light curves  
spectroscopic followup

N S



- Type Ia supernovae (SNe)
  - spectroscopically confirm and obtain “well-measured” light curves of  $\sim 200$  SN Ia from  $z = 0.05 \sim 0.4$  in u,g,r,i and z
  - understand and minimize systematics of SN Ia
- Other SN-Types Ib/c, Type II
- Rates and Environment

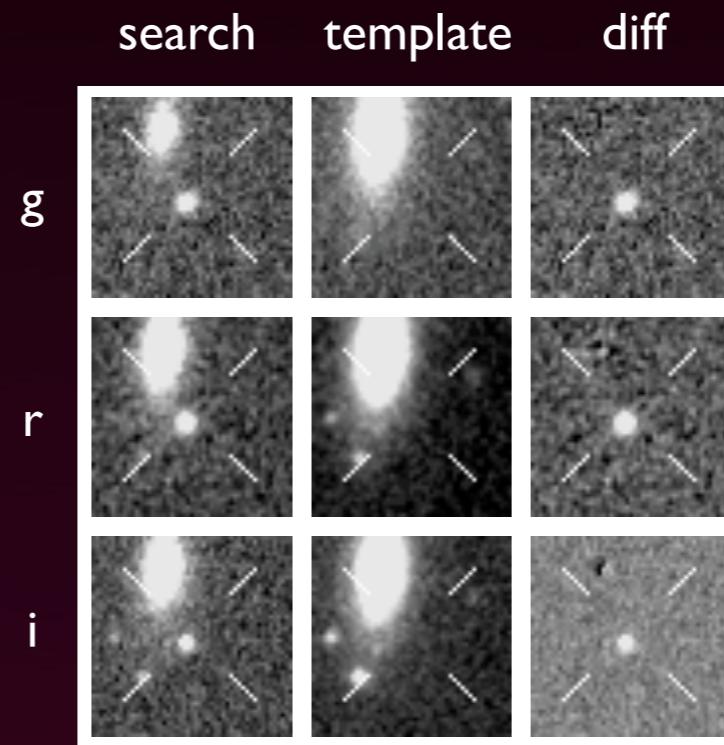
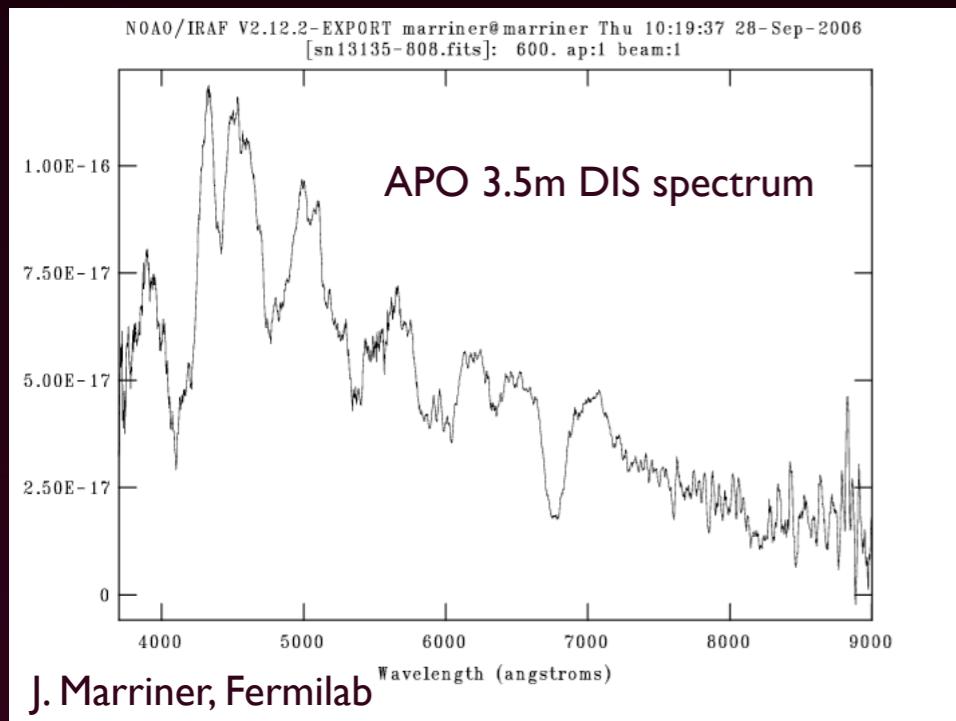
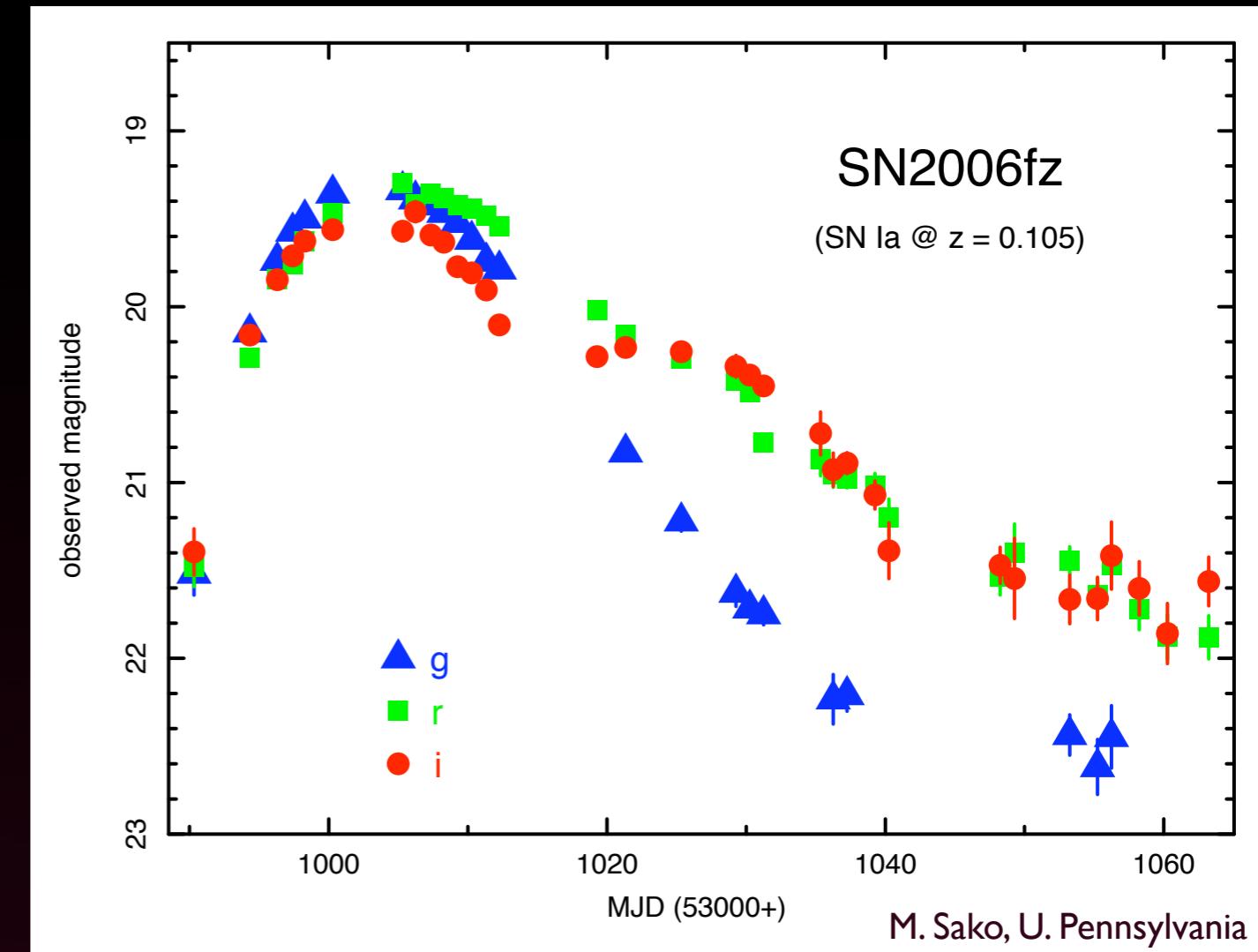


# Details for Candidate SN13135

Initial RA (deg)	4.172303
Initial Dec (deg)	-0.424537
Averaged RA (deg)	4.172286
Averaged Dec (deg)	-0.424540
Averaged RA (hh:mm:ss)	0:16:41.35
Averaged Dec (dd:mm:ss)	-0:25:28.3
Redshift	0.1050
IUAC Name	2006fz
Observability	0.000
Time weight	0.000
Crowding weight	-1.000
Dust weight	-1.000
Entry date/time	2006-09-16 18:00:38

## Fits

Fit type	Best	Criterion A	Criterion B
z fit	la	la	la
z constrained	la	la	la

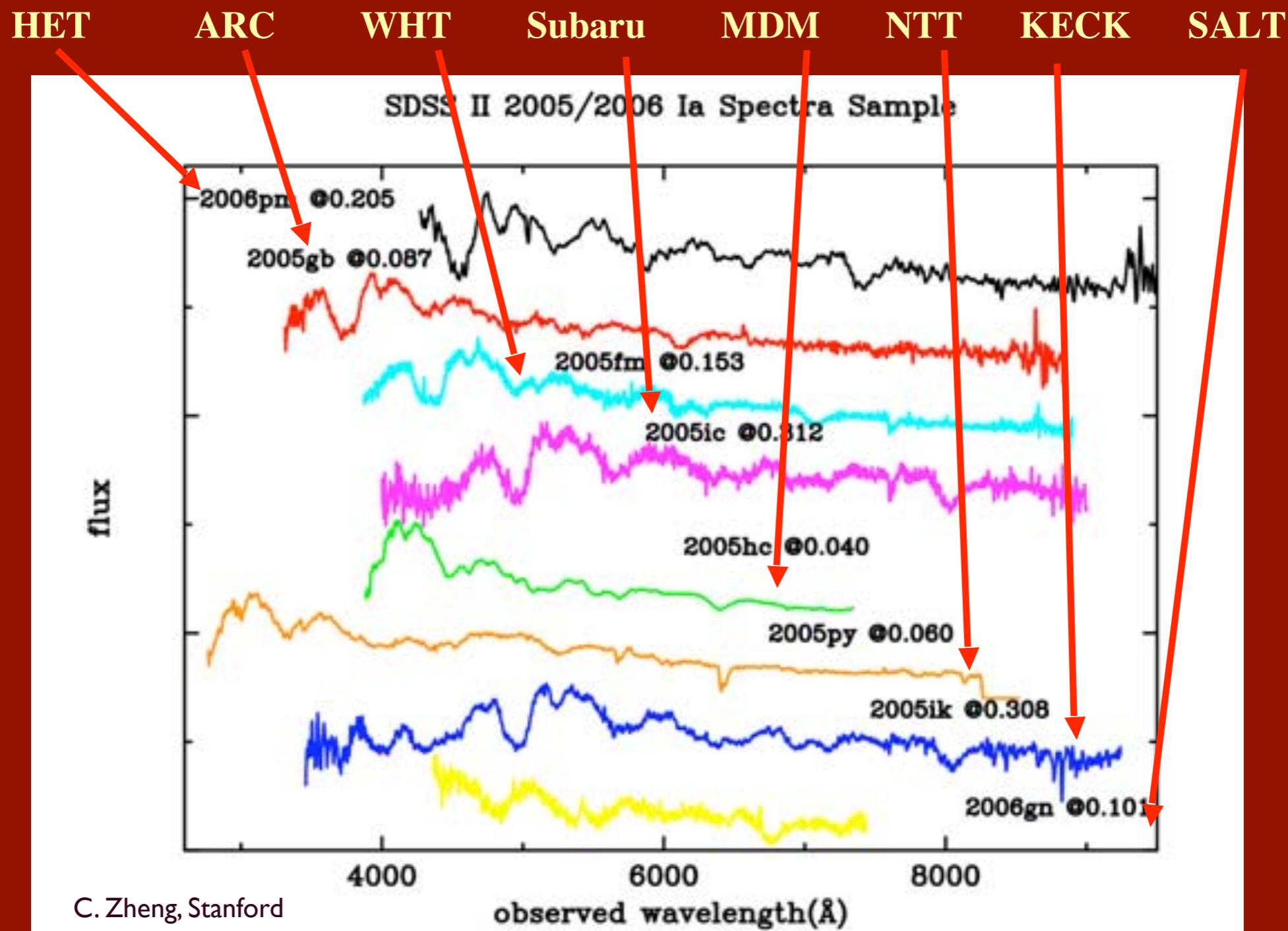


SN 2006fz  
SN Ia  $z = 0.105$

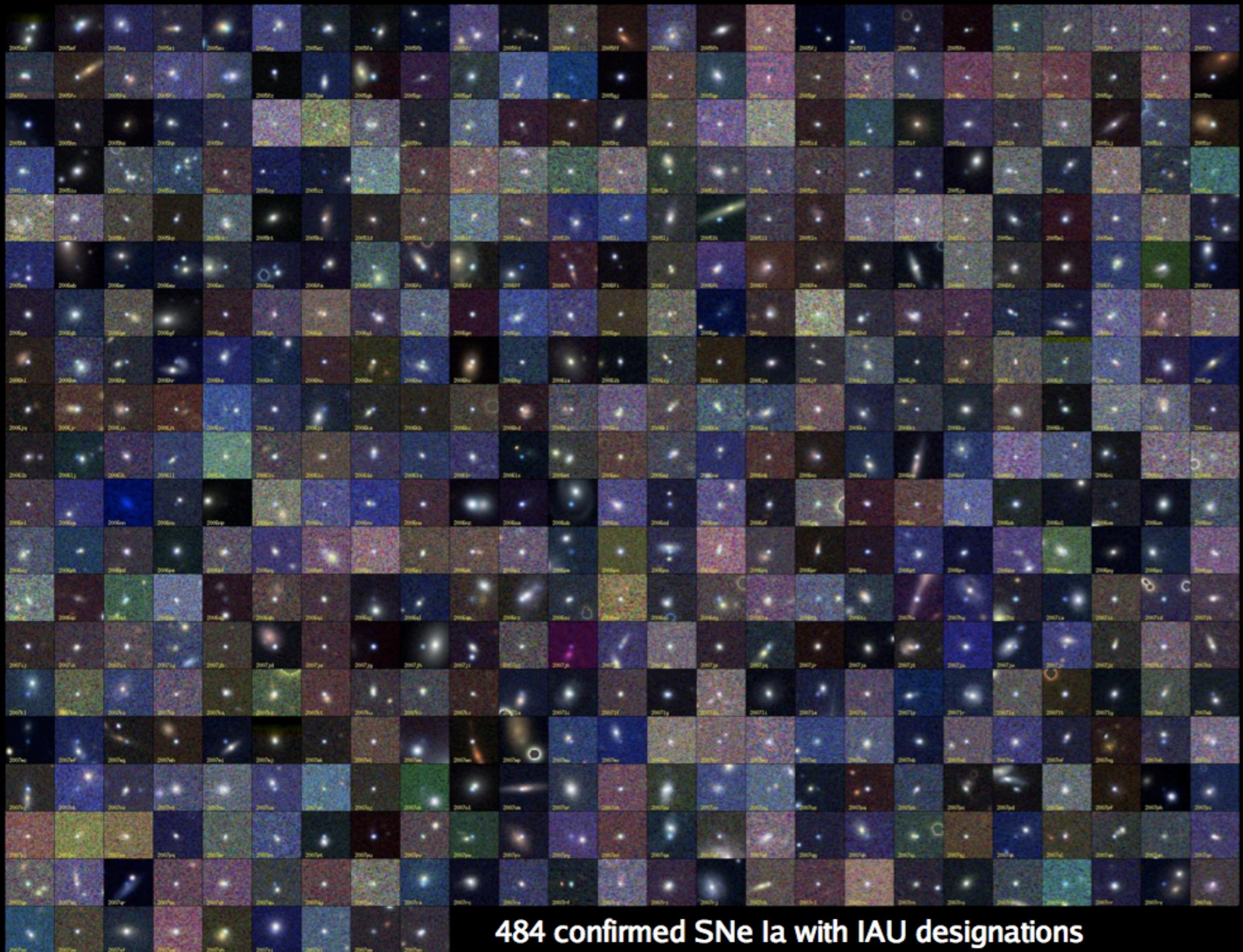
Bassett et al. (2007), CBET 627

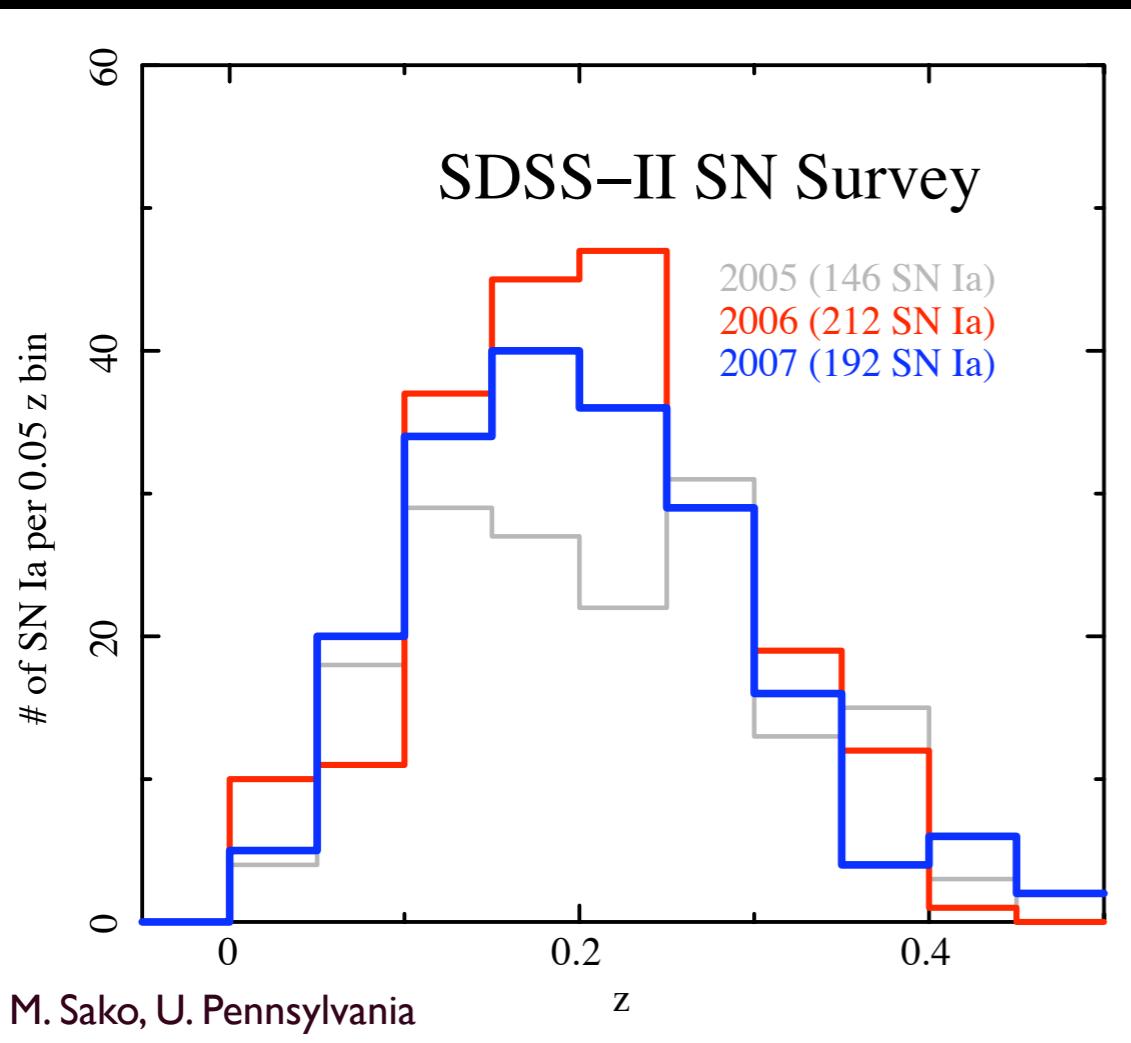
# SDSS SN Spectroscopy

Zheng et al. (2008)



**484 confirmed SNe Ia with IAU designations**



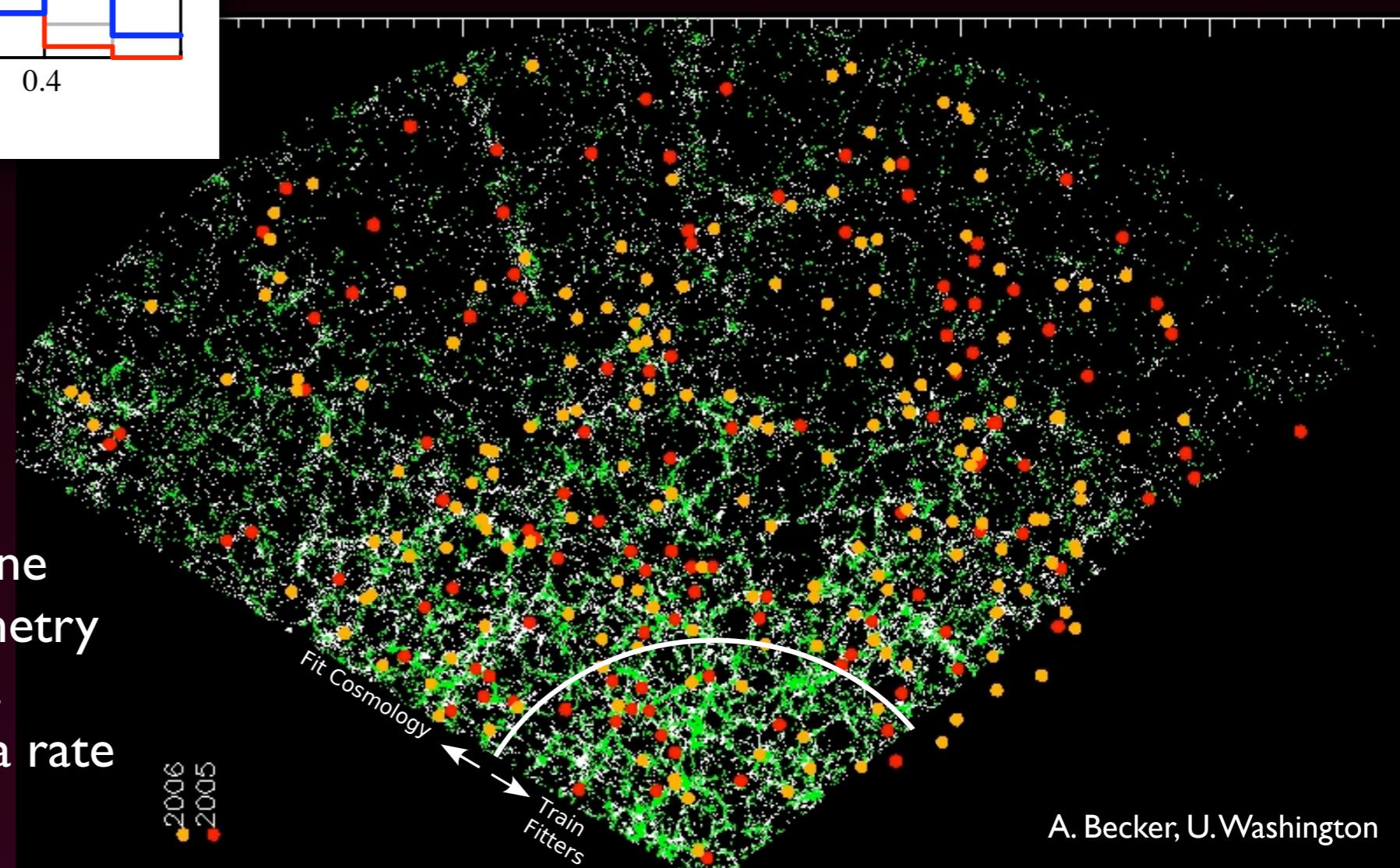


498 spectroscopically confirmed SN Ia  
+ 52 probable SN Ia,  
all in 9 months of searching  
(Sep-Nov 2005-2007)

→ highest yield for any SN search

SDSS SN papers:

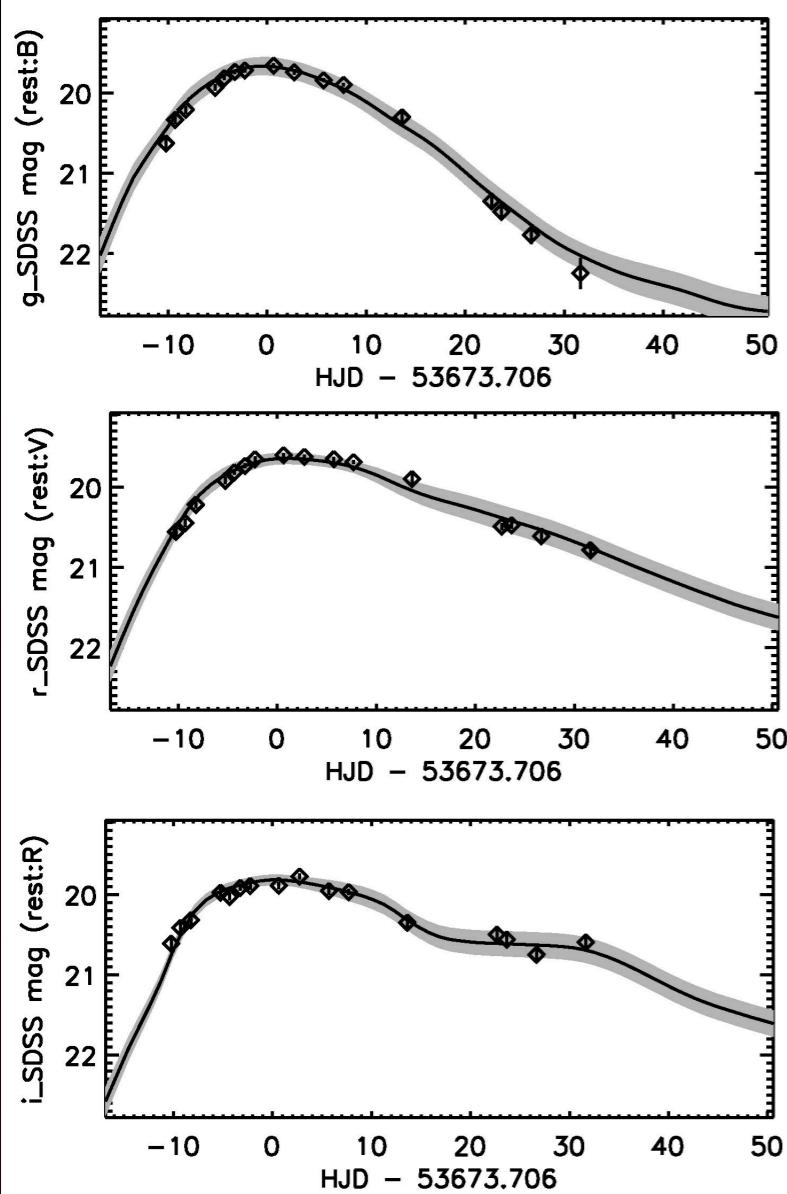
- Frieman et al. (2008): overview
  - Sako et al. (2008): search/pipeline
  - Holtzman et al. (2008): photometry
  - Zheng et al. (2008): SN spectra
  - Dilday et al. (2008): low-z SN Ia rate
- ...



# MLCS2k2 light-curve fits

Jha, Riess, & Kirshner (2007)

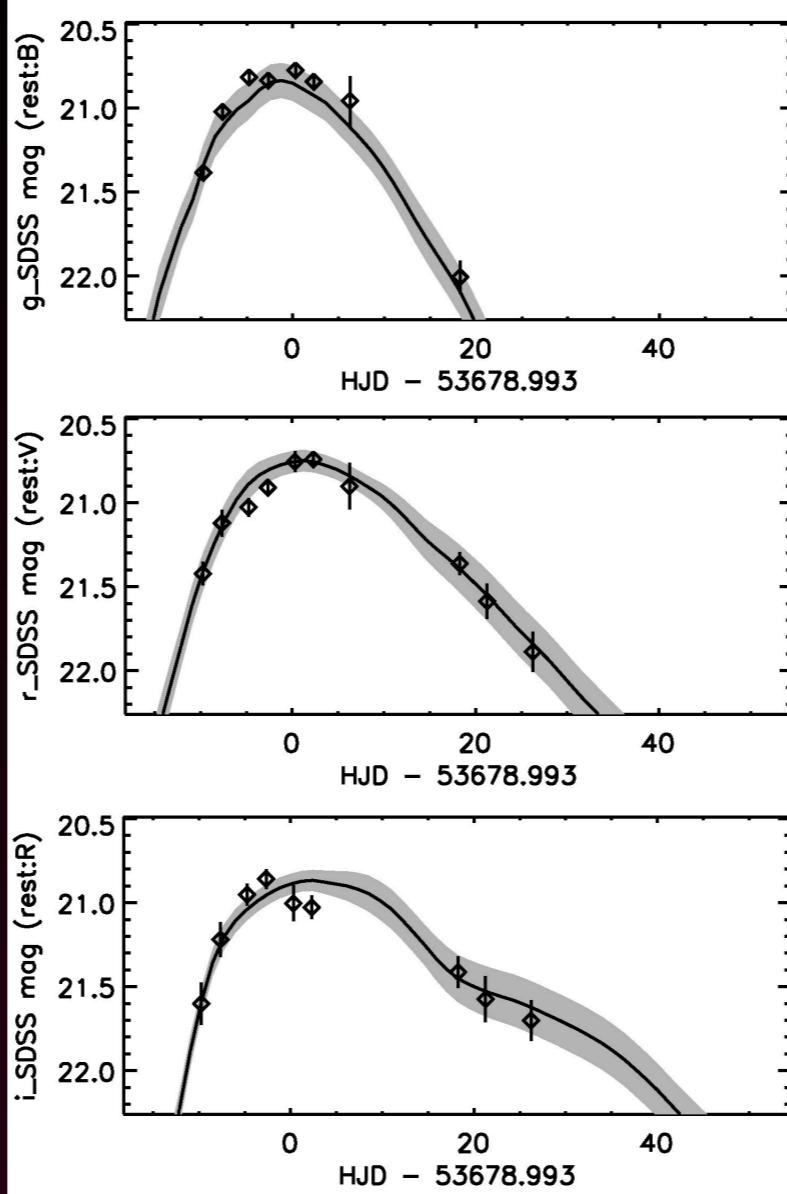
SN 2005ij  $z = 0.124$



sn06406\_SMP01\_gri

$t_0 = 53673.706$   $R_v = 3.10$   
 $\Delta = -0.14$   $A_v = 0.20$   
 $\mu_0 + 5 \log (H_0/65) = 39.12$   
 $E(B-V)_{MW} = 0.08$   $z = 0.1240$   
 $\chi^2/\nu = 21.32/44$

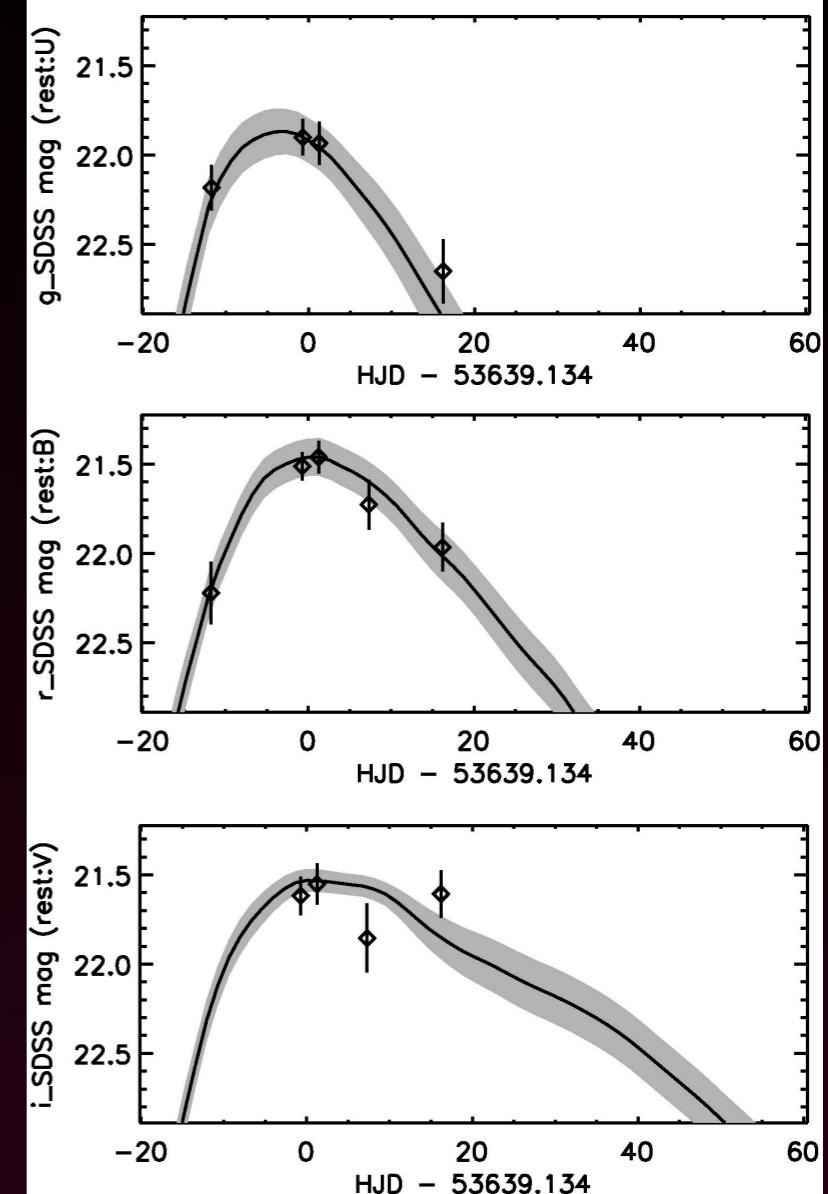
SN 2005ji  $z = 0.214$



sn07473\_SMP01\_gri

$t_0 = 53678.993$   $R_v = 3.10$   
 $\Delta = -0.02$   $A_v = 0.09$   
 $\mu_0 + 5 \log (H_0/65) = 40.50$   
 $E(B-V)_{MW} = 0.02$   $z = 0.2140$   
 $\chi^2/\nu = 15.52/23$

SN 2005fs  $z = 0.344$

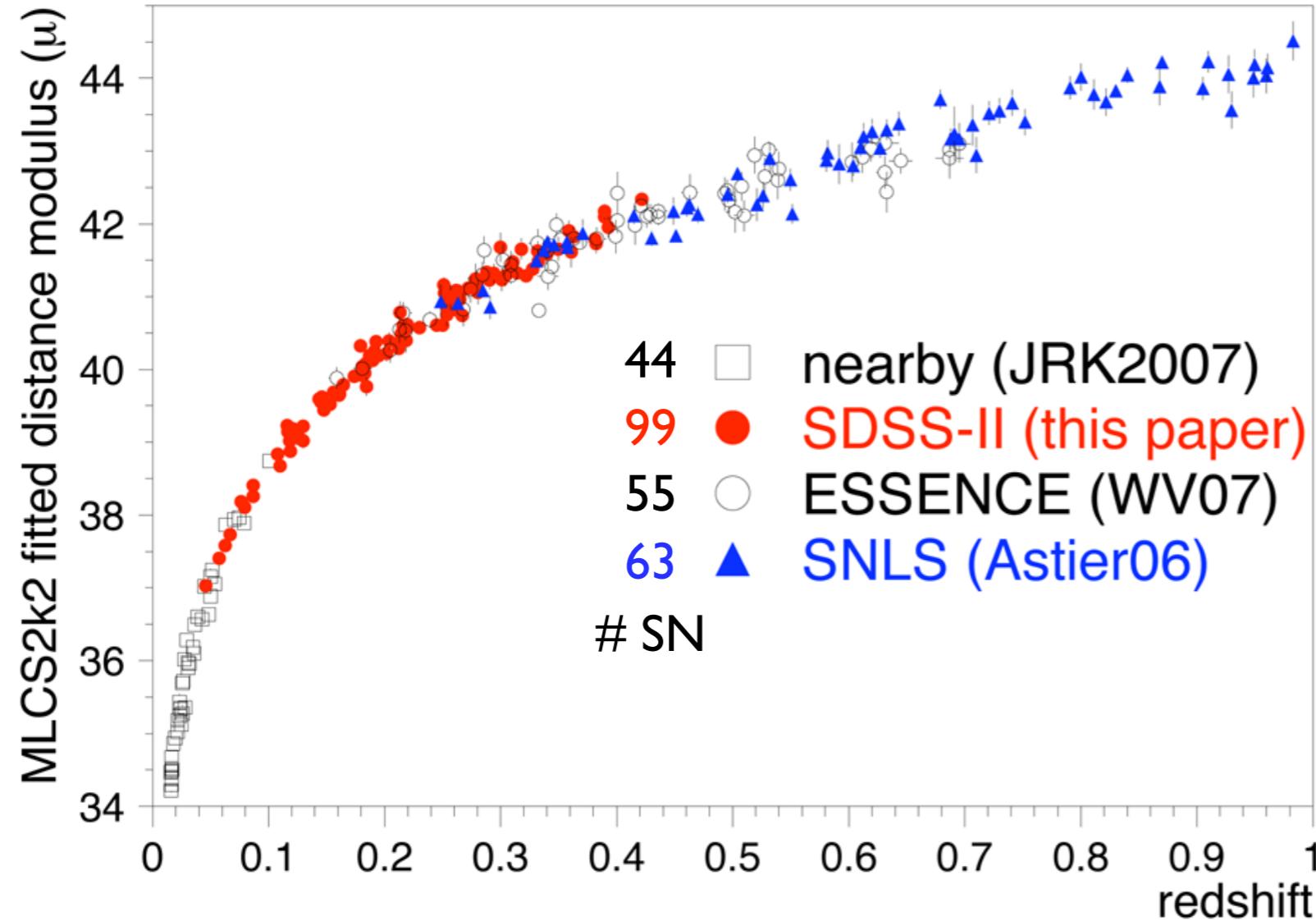


sn02533\_SMP01\_gri

$t_0 = 53639.134$   $R_v = 3.10$   
 $\Delta = -0.32$   $A_v = 0.10$   
 $\mu_0 + 5 \log (H_0/65) = 41.56$   
 $E(B-V)_{MW} = 0.03$   $z = 0.3440$   
 $\chi^2/\nu = 5.86/9$

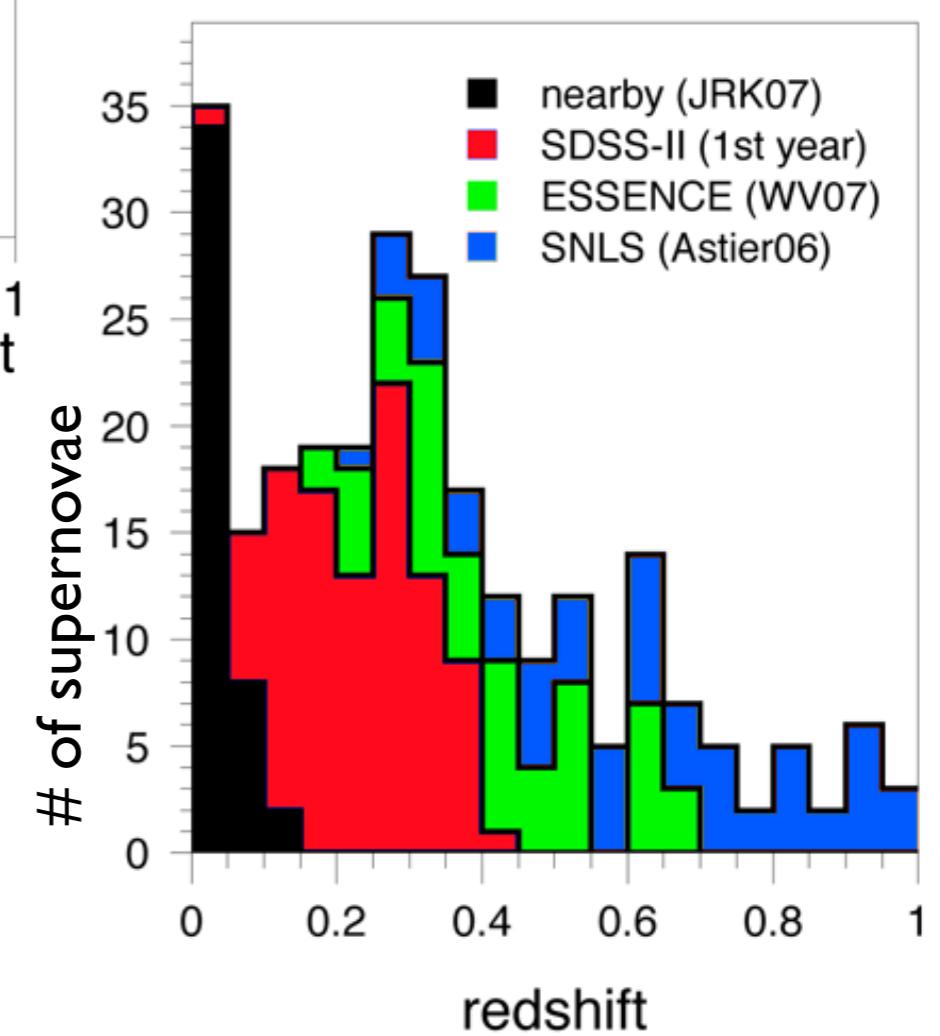
# Preliminary Results

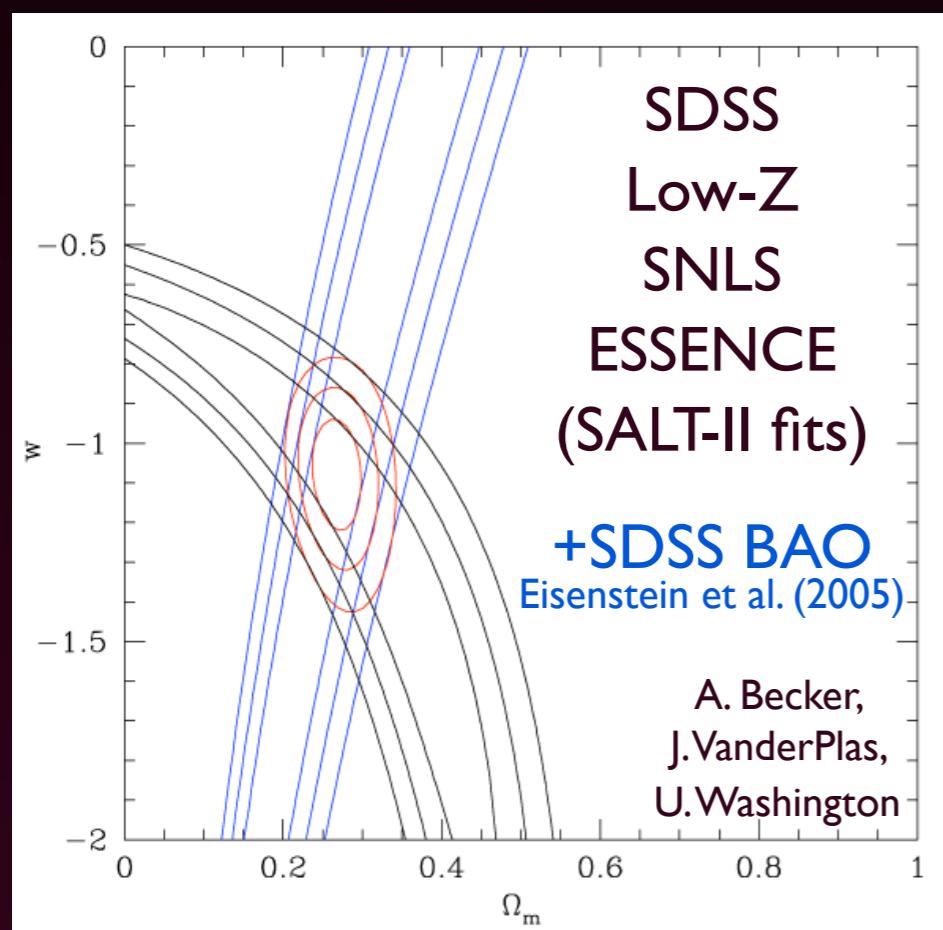
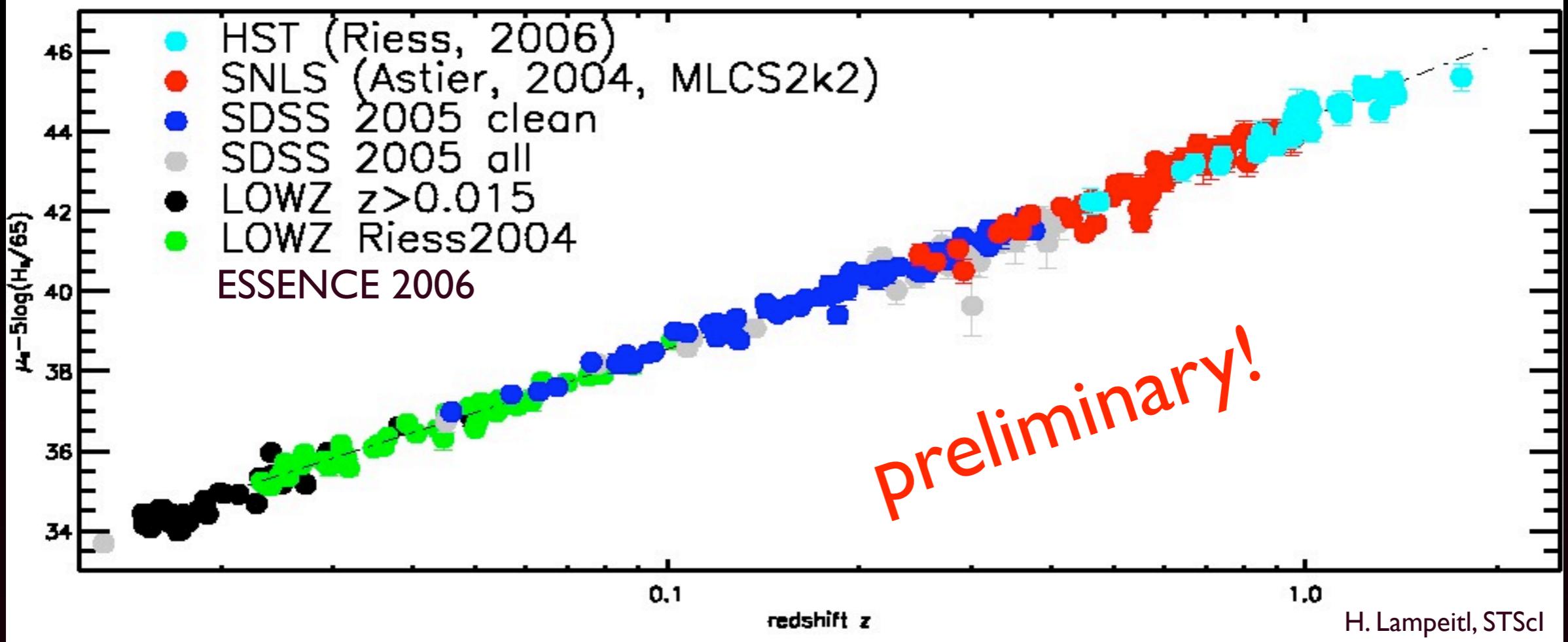
MLCS2k2 and SALT-II light curve fits, with full Monte Carlo simulation of surveys



fit-quality parameter	Result for sample:			
	Nearby	SDSS-II	ESSENCE	SNLS
$\chi^2_\mu$ (independent fits)	43.0	54.6	59.2	62.2
$N_{dof}$	41	96	52	60
$RMS_\mu$	0.18	0.13	0.23	0.21
$\chi^2_\mu$ (global fit)	46.5	61.3	66.6	64.3

Kessler et al. (2008)





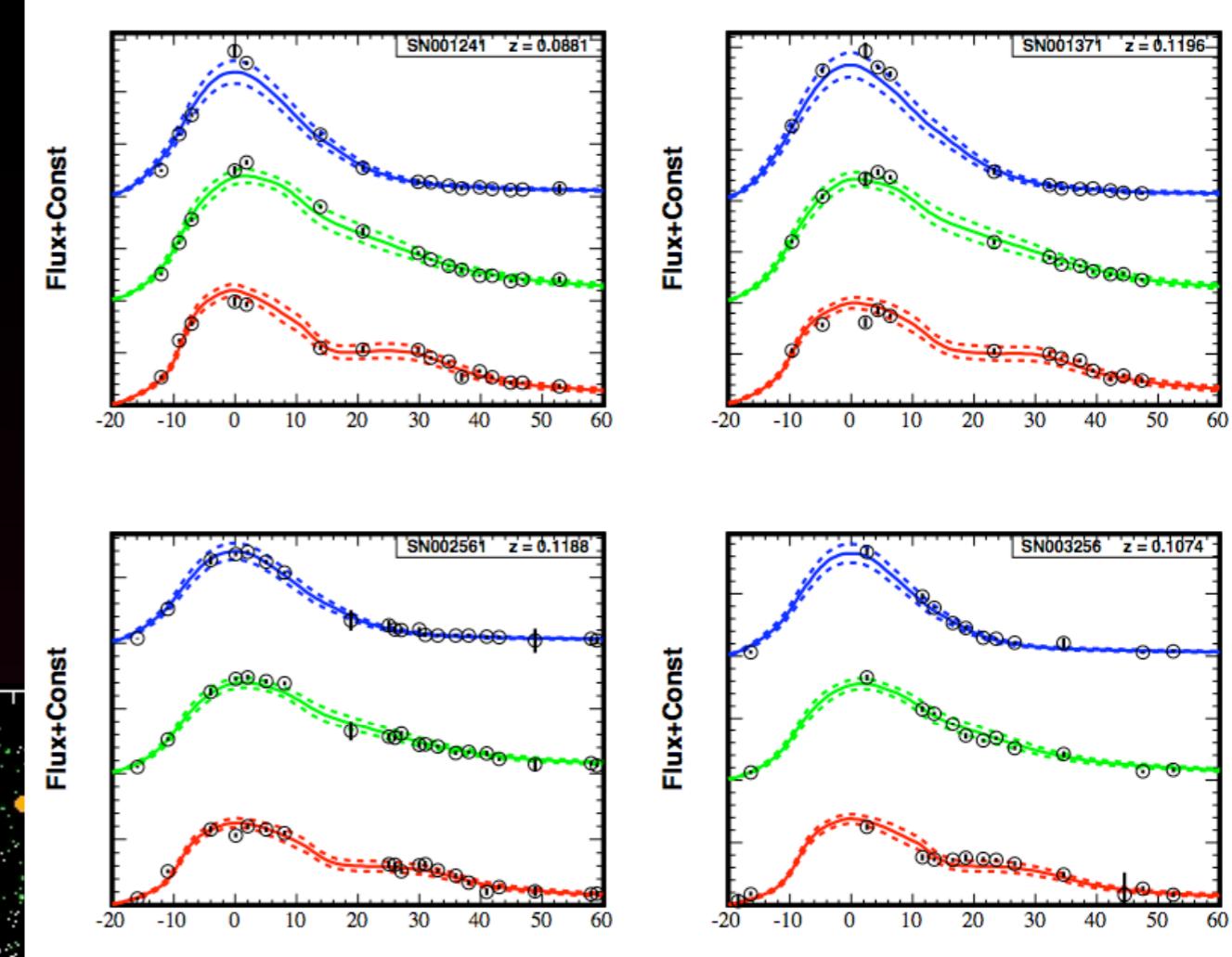
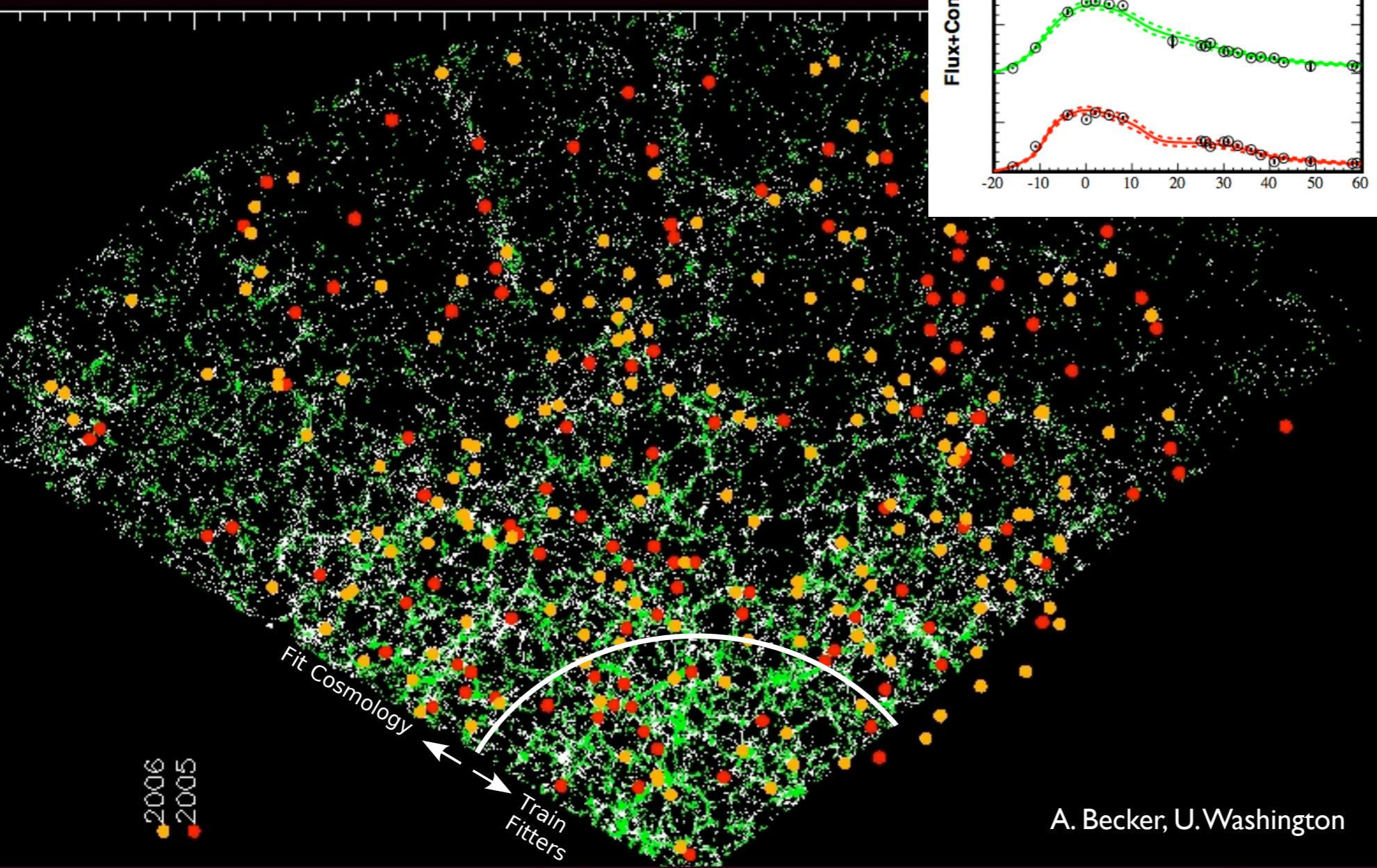
for the first time we have a continuous expansion history measured from SN to  $z > 1$

full three year sample (data in hand) will have nearly 4x as many objects

Kessler et al. (2008)

toward a self-contained cosmology  
analysis... 87 SN Ia at  $z < 0.12$   
retrain fitters, limit systematics

large homogeneous sample to get  
ready for future surveys, e.g. >600  
photometric-only likely SN Ia



Dilday et al. (2008)

stay tuned!

